In the Claims

1. (currently amended) A method of generating output seismic trace data at a specified location from input seismic trace data from known locations comprising the steps of:

>   selecting a specified location for the output data;

>   selecting input data at known locations for fitting to a multi-order polynomial equation;

>   obtaining polynomial fit parameters of the multi-order polynomial equation; and

>   utilizing the polynomial fit parameters to obtain seismic trace data at the selected location by interpolation.

2. (original) A method as in claim 1 wherein the step of selecting the location for the output data includes selection of both a desired source point and a desired receiver point.

3. (original) A method as in claim 1 wherein the step of selecting input data at known locations for fitting to a multi-order polynomial equation includes selecting input data within a specified range of the specified location of the output data.

4. (original) A method as in claim 3 wherein the specified range is defined by the parameters of an ellipse.

5. (original) A method as in claim 3 wherein the input data within the specified range is further restricted by selection of input data closest to the specified location of the output data.

6. (original) A method as in claim 1 wherein the step of obtaining polynomial fit parameters of the multi-order polynomial equation is solved numerically by a singular value decomposition of a matrix, C, defined by $C = ULV^T$.

7. (original) A method as in claim 6 wherein a transformed coordinate system is utilized to speed up the computation time required to solve for the polynomial fit parameters of an interpolated trace.

8. (original) A method as in claim 1 wherein each of the steps are repeated to form a shot gather corresponding to predicted receiver trace data at known or unknown locations and corresponding to a known source location or predicted source location.

9. (original) A method as in claim 1 wherein the specified location is a known location and wherein the method is effective in reducing random noise associated with the trace data at that known location.

10. (currently amended) A method of creating a shot gather from known seismic trace data obtained from a plurality of known locations within an x,y grid, the method comprising the steps of:

    a. selecting a source location within the x,y grid to which the shot gather will correspond;

    b. selecting a plurality of receiver positions that will form receiver positions for the shot gather wherein at least one of the source location or receiver positions is an unknown position;

    c. selecting a plurality of receiver traces having known positions as input traces and utilizing the known receiver traces to ~~predict~~ interpolate receiver trace data at a location adjacent the known receiver positions utilizing a least-squares fitting model;

    d. repeating step c for all selected receiver positions so as to form a shot gather corresponding to the source location.

11. (original) A method as in claim 10 wherein the source location is a location on the x,y grid that does not correspond to an actual source location.